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(54) PLASMA DISPLAY PANEL

(57)Abstract:

PROBLEM TO BE SOLVED: To minimize a nonselective potential VSC within the range causing no mis-address, while using a zinc silicate phosphor by laminating a film capable of changing the polarity of a phosphor layer to positive on the phosphor layer made of a zinc silicate green luminant having the electrification of a negative polarity.

SOLUTION: A zinc silicate phosphor having the electrification of a minus polarity is used, and a film made of a material capable of changing the polarity of the phosphor to plus is laminated on the surface of the phosphor. Zn2SiO4: Mn, Zn2SiO4: As, Zn2GeO4: Mn, Zn2GaO4: Mn can be used for the zinc silicate phosphor. Al2O3, MgO, BaO, ZnO can be used for the film capable of changing the polarity to positive. Deposition or baking can be used for the laminating method, so that the film is laminated on the phosphor layer at a ratio of 0.1-0.5 wt.% to the phosphor.

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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The plasma display panel characterized by carrying out the laminating of the film which can make the polarity of a fluorescent substance layer plus on the fluorescent substance layer which electrification nature becomes from the zinc silicate system green emitter of a minus polarity.
[Claim 2] The plasma display panel of claim 1 with which the film which can make the polarity of a fluorescent substance layer plus consists of aluminum 2O3, MgO, BaO, or ZnO.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a plasma display panel (Following PDP is called).
[0002]
[Description of the Prior Art] Generally PDP consists of components, such as a substrate of the couple which counters, an electrode, a septum, a fluorescent substance layer, and discharge gas. Moreover, discharge space is divided by the substrate and septum of a couple, and a fluorescent substance layer and discharge gas exist in discharge space. The display is performed by changing into the light the vacuum ultraviolet radiation generated from discharge gas with the fluorescent substance in a fluorescent substance layer.
[0003] Moreover, in the case of the color PDP, red and three kinds of fluorescent substances which can change vacuum ultraviolet radiation into the light of green and blue are used. Generally in the inside of this, and a green fluorescent substance, it is Zn2 SiO4. : The fluorescent substance of a zinc silicate system like Mn and the fluorescent substance which consists of mixture of the fluorescent substance of a zinc silicate system and BaAl12O19:Mn (following, BAM) are used.
[0004]
[Problem(s) to be Solved by the Invention] As a method of driving PDP, the approach as shown in drawing 1 is learned. First, the homogeneity of the space potential condition of all the cels in a panel is carried out complete burning (refer to drawing 1 (a)) and by subsequently performing complete elimination (referring to drawing 1 (b)). Then, in order to choose a desired cel, the write-in selection potential (- Vy) of a minus polarity is impressed for Yevery selection electrode of one line (henceforth, selection line). Simultaneously, the non-choosing electrode Y2 of other lines (line non-choosing [the following and]) is -Vy so that it may not be made to choose. - (Vy-Vsc) which applied the non-choosing potential (Vsc) of high potential is impressed.
[0005] If Vsc is not high enough here, discharge will take place also with a non-choosing line. When discharge arises with a non-choosing line, a plus charge will accumulate on the non-choosing electrode Y2 of the line. Next, if the non-choosing line covered with this plus charge is chosen, even if it impresses selection potential (- Vy), discharge does not arise between address electrodes, and an indication may not be given. This phenomenon is called the address mistake.
[0006] It is known that there is temperature dependence in the minimum value of Vsc for preventing an address mistake, and the minimum value of Vsc also becomes high with lifting of temperature. For this reason, it becomes impossible for the temperature in a cel to rise, if burning of PDP is continued, and to control discharge of a non-choosing cel, and CHIRATSUKI may arise in a non-choosing cel. On the other hand, when Vsc is made high too much, the phenomenon called the so-called occurrence discharge which discharge runs along with the address electrode A irrespective of either to selection and a non-choosing cel will arise. This occurrence discharge becomes the cause which destroys IC for actuation for controlling the electrical potential difference impressed to an address electrode.
[0007] Therefore, Vsc is the range which an address mistake does not produce and a thing low as much as possible is desired. However, since it was high compared with the fluorescent substance of the blue of others [Vsc], and red, the fluorescent substance of the zinc silicate system currently used as a green fluorescent substance had a possibility that an address mistake might arise. Moreover, CHIRATSUKI as which BAM which is a green fluorescent substance determines Vsc is not green, is blue, and can make Vsc low more than 10V rather than the fluorescent substance of a zinc silicate system. However, it was difficult to BAM for brightness degradation to use only BAM as a green fluorescent substance early.
[0008] Therefore, to make it fall as much as possible was desired in the range in which an address mistake does not produce Vsc, using the fluorescent substance of a zinc silicate system.

[0009]
[Means for Solving the Problem] According to this invention, the plasma display panel characterized by carrying out the laminating of the film which can make the polarity of a fluorescent substance layer plus on the fluorescent substance layer which electrification nature becomes from the zinc silicate system green emitter of a minus polarity is offered in this way.
[0010]
[Embodiment of the Invention] As for the artificer of this invention etc., Vsc of the fluorescent substance of a zinc silicate system examined the high reason compared with the fluorescent substance of other blue and red. The electrification inclination of the various fluorescent substances on the basis of Fe is shown in drawing 2 . moreover, Zn2 SiO4 which is the fluorescent substance of a zinc silicate system at a table 1 : the amount of electrifications of Mn -- BAM and MgAl(Ba, Eu) 10O17: -- Eu (blue fluorescent substance) and BO (Y, Gd)3 : It combines with the amount of electrifications of Eu (red fluorescent substance), and is shown.
[0011]
[A table 1]

	帯電量（μC／g）
Zn_2SiO_4 :Mn	−39.6
BAM	47.7
青色蛍光体	58.5
赤色蛍光体	52.9

[0012] As shown in above-mentioned drawing 2 and a table 1, the polarity of the electrification nature of the fluorescent substance of a zinc silicate system is minus, and serves as BAM, a blue fluorescent substance, and a red fluorescent substance conversely. From this, it is guessed that the reason nil why Vsc of the fluorescent substance of a zinc silicate system is high has a problem in the polarity of electrification nature. When the fluorescent substance which has a minus polarity is used for below, why Vsc becomes high is considered.
[0013] Drawing 3 (a) - (c) shows the case where the electrification nature of a fluorescent substance is a minus polarity. First, the space potential condition of all the cels in a panel is made into homogeneity complete burning (refer to drawing 3 (a)) and by subsequently performing complete elimination (referring to drawing 3 (b)). The charge of minus becomes easy to remain when the electrification nature of a fluorescent substance is a minus polarity, as drawing 3 (b) shows.
[0014] Then, in order to choose a desired cel, the write-in selection potential (- Vy) of a minus polarity is impressed for Yevery selection electrode of one line (henceforth, selection line). Simultaneously, the non-choosing electrode Y2 of other lines (line non-choosing [the following and]) is -Vy so that it may not be made to choose. - (Vy-Vsc) which applied the non-choosing potential (Vsc) of high potential is impressed. On the other hand, when the fluorescent substance which has a plus polarity is used, a display is performed by driving, as shown in drawing 1 .
[0015] Here, the difference of the driving method polar [minus polar and plus polar] in the electrification nature of a fluorescent substance is the difference in the amount of the plus charge on Y1 and Y2 electrode after complete elimination. That is, when the electrification nature of a fluorescent substance is a plus polarity, three plus charges remain, but when the electrification nature of a fluorescent substance is a minus polarity, on Y1 and Y2 electrode, the charge of minus and plus negates each other and has become "0." Therefore, the direction in case the electrification nature of a fluorescent substance with many plus charges is a plus polarity can explain [Vsc] becoming low theoretically. This shows that it is advantageous that the electrification nature of a fluorescent substance has a plus polarity.
[0016] In this invention, the polarity of the amount of electrifications uses the fluorescent substance of the zinc silicate system which is minus, and is setting to one of the descriptions to carry out the laminating of the film on the surface of a fluorescent substance with the ingredient which can change the polarity of this fluorescent substance into plus. As a fluorescent substance of the zinc silicate system which can be used for this invention, it is Zn2 SiO4. : Mn, Zn2 SiO4 : As, Zn2 GeO4 : Mn, Zn2 GaO4 : Mn etc. is mentioned. Moreover, these fluorescent substances may be combined and used.

[0017] Furthermore, other fluorescent substances may be mixed. As other fluorescent substances, it is BAM and LaPO4. : Tb, ZnS: (Cu, aluminum), ZnS: (Au, Cu, aluminum), S(Zn, Cd): (Cu, aluminum), Y3 aluminum5 O12:Ce, Gd2 O2 S:Tb, Y3aluminum5 O12:Tb, ZnO:Zn, etc. are mentioned. Among this, BAM, LaPO4:Tb, ZnS: (Cu, aluminum), Y3 aluminum5 O12:Ce, Gd2 O2 S:Tb, and Y3 aluminum5 O12:Tb are desirable.
[0018] Although the fluorescent substance of a zinc silicate system is different with the class of fluorescent substance to be used when mixing the fluorescent substance of a zinc silicate system, and other fluorescent substances here, it is desirable to be contained at 60% of the weight or more of a rate in the fluorescent substance whole quantity. Especially the formation approach of a fluorescent substance layer is not limited, but each well-known approach can be used for it. For example, after applying the paste containing a fluorescent substance to a request part, it can form by calcinating. Here, for a paste, resin, a solvent, etc. may be added for viscosity accommodation.
[0019] As resin which can be used, each well-known resin can be used in the field concerned. Ethyl cellulose, a nitrocellulose, acrylic resin, polyvinyl alcohol, etc. are mentioned, and, specifically, the photopolymer etc. may be included further. On the other hand, as a solvent, alcohols, a terpineol, butyl carbitol acetate (BCA), butyl carbitol, toluene, butyl acetate, etc. are mentioned.
[0020] The above-mentioned paste is applied on a fluorescent substance layer forming face by well-known approaches, such as screen printing, a doctor blade method, the slot coating-machine method, and the bar coating-machine method. Then, a fluorescent substance layer can be formed by calcinating the applied paste. In addition, when the paste containing a photopolymer is used, it is also possible by applying, exposing, developing negatives and calcinating to form a fluorescent substance layer in a request field.
[0021] Next, on the fluorescent substance layer, the laminating of the film which can make the polarity plus is carried out. As film which can make a polarity plus, aluminum 2O3, MgO, BaO, ZnO, etc. are mentioned. If only it can add the polarity of a fluorescent substance, the laminating of this film may be selectively carried out on the fluorescent substance layer, and it may be covered thoroughly. Each well-known approach can be used especially as the laminating approach of the film which can make a polarity plus, without being limited. For example, vacuum deposition, the calcinating method, etc. are mentioned. Here, as for the film which can make a polarity plus, it is desirable to carry out a laminating on a fluorescent substance layer to a fluorescent substance, so that it may become 0.1 - 0.5% of the weight of a rate. In addition, the film which can make a polarity plus is aluminum 2O3. It is especially desirable.
[0022] Next, an example of PDP which has the fluorescent substance layer of this invention is explained, referring to drawing 4 . In addition, the configuration of drawing 4 is an example, and if this invention is PDP which has a fluorescent substance layer, without being limited to this, it is applicable to PDP of any formats, such as AC mold and DC mold. Drawing 4 is an outline perspective view corresponding to the field discharge mold PDP of a general indirect discharge format (AC mold), according to the classification by the arrangement gestalt of a fluorescent substance layer, belongs to a reflective mold and shows PDP of 3 electrode structures.
[0023] The substrates 11 and 21 of a couple counter and PDP1 of drawing 4 is arranged. As a substrate, a glass substrate, a quartz substrate, a silicon substrate, etc. can be used. The dielectric layer 17 for the couple [every] alternating current (AC) actuation which maintains discharge with a wall electrode on a substrate 11 is formed in parallel in every [whose display electrodes X and Y are the horizontal cel trains of a screen] line L at a substrate 11 so that it may be formed and the display electrodes X and Y may be covered, and the protective coat 18 is further formed on the dielectric layer 17. Being able to form a dielectric layer by generally applying and calcinating a low-melting-glass paste, the thickness is about 7000A. Moreover, generally a protective coat consists of MgO etc.
[0024] On the other hand, the address electrode A of the shape of two or more stripe is formed in the location which a substrate 21 is covered with the substrate layer 22, looks at it superficially on the substrate layer 22, and intersects perpendicularly with the display electrodes X and Y, and the laminating of the dielectric layer 24 is carried out on the substrate 21 so that this address electrode A may be covered. An address electrode consists of Ag, Au, aluminum, Cu, Cr(s), those layered products (for example, Cr/Cu/Cr), etc., and can be formed at intervals of a request number, thickness, and width of face by combining the forming-membranes method and the etching methods, such as a spatter and vacuum deposition, here.
[0025] Furthermore, the septum 29 of the shape of two or more stripe is formed so that it may become this address electrode A and parallel between the adjoining address electrodes A. A septum 29 can be formed by the sandblasting method, print processes, the photo etching method, etc. Subsequently, on the side face of the adjoining septum 29, and the address electrode A, the fluorescent substance layers 28R, 28G, and 28B are formed. Next, 30 shows discharge space, and is divided for every unit luminescence field in the drawing direction of the display electrodes X and Y, and the gap dimension is specified. In addition, desired discharge gas is enclosed with discharge space 30.
[0026] The selection discharge cel for PDP1 to choose a display or un-displaying as the intersection of the display

electrode Y and the address electrode A in each of three unit luminescence fields corresponding to one pixel like drawing 4 is decided. Moreover, the main-stroke cel is demarcated among the display electrodes X and Y. Here, the fluorescent substance layers 28R, 28G, and 28B are formed between the septa 29 on the display electrodes X and Y and the substrate 21 of an opposite hand, in order to avoid the impact by the ion produced by field discharge. These fluorescent substance layers 28R, 28G, and 28B emit light by changing into the light the vacuum ultraviolet radiation produced by field discharge of a main-stroke cel. The light which emitted light in the fluorescent substance layers 28R, 28G, and 28B penetrates a dielectric layer 17 and a substrate 11, and is injected outside. That is, in PDP1, the outside surface of a substrate 11 turns into the screen.

[0027] The display electrodes X and Y consist of metal electrodes 42 (bus electrode) with the narrow width of face for compensating the transparent electrode 41 with wide width of face (Sas Tin electrode), and its conductivity, in order to make field discharge wide range and to make protection from light of display light into the minimum, since it is arranged at a screen side to the fluorescent substance layers 28R, 28G, and 28B. The Sas Tin electrode consists of gold oxide groups, such as ITO (indium oxide + tin oxide) and Nesa (tin oxide), and can be formed at intervals of a desired number, thickness, and width of face by combining the forming-membranes method and the etching methods, such as vacuum evaporationo. On the other hand, a bus electrode consists of Ag, Au, aluminum, Cu, Cr(s), those layered products (for example, Cr/Cu/Cr), etc., and can be formed at intervals of a request number, thickness, and width of face by combining the forming-membranes method and the etching methods, such as a spatter and vacuum deposition.

[0028] PDP1 is constituted as mentioned above by sticking two substrates, the substrate 11 (front substrate) with the dielectric layer 17 for maintaining a bonnet and discharge for the display electrodes X and Y, and the substrate 21 (tooth-back substrate) with the septum 29 for dividing discharge space 30. Next, an example of the actuation approach applicable to PDP1 is explained.

[0029] Drawing 5 is the mimetic diagram of frame division, and drawing 6 is the electrical-potential-difference wave form chart showing an actuation sequence. In order for binary control of luminescence of a cel to perform a gradation expression, each frame F of the time series which is an input image from the outside is divided into six subframes sf1, sf2, sf3, sf4, sf5, and sf6. Weighting is carried out so that the rate of phase comparison of the brightness in each subframes sf1-sf6 may be set to 1:2:4:8:16:32, and the count of luminescence of Sas Tin of each subframes sf1-sf6 is set up. Since 64 steps of brightness setting out of level "0" - "63" can be performed for every color of RGB in the combination of the existence of luminescence of a subframe unit, the number of the colors which can be displayed is 643. It becomes. In addition, it is not necessary to display subframes sf1-sf6 in order of the weight of brightness. For example, optimization of arranging the subframe sf6 with large weight in the medium of a display period can be performed.

[0030] Like drawing 6 , the reset period TR, the address period TA, and the Sas Tin period TS are assigned to each subframes sf1-sf6. Although the die length of the reset period TR and the address period TA is fixed irrespective of the weight of brightness, the die length of the Sas Tin period TS is so long that the weight of brightness is large. That is, the die length of the display period of each subframes sf1-sf6 differs mutually.

[0031] The reset period TR is a period which eliminates wall charge of the whole screen (initialization) in order to prevent the effect of the burning condition before it. The reset pulse Pw of the straight polarity to which peak value exceeds field breakdown voltage is impressed to the Sas Tin electrode X of all lines (the number of lines is n), and in order to prevent electrification by the side of a tooth back, and an ion bombardment simultaneously, the pulse of straight polarity is impressed to all the address electrodes A. In response to the standup of a reset pulse Pw, strong field discharge arises with all lines, and a lot of wall charge arises in a cel (complete burning). Effective voltage falls by offset with wall voltage and applied voltage. If a reset pulse Pw falls, wall voltage turns into effective voltage as it is, self-discharge arises, almost all wall charge disappears in all cels, and the whole screen will be in the uniform condition of not being charged (complete elimination).

[0032] The address period TA is a period which performs addressing (setting out of burning / astigmatism LGT). Bias of the Sas Tin electrode X is carried out to forward potential to touch-down potential, and bias of all the Sas Tin electrodes Y is carried out to negative potential. In this condition, it chooses each line of one line from a top line at a time in order, and the scanning pulse Py of negative polarity is impressed to the corresponding Sas Tin electrode Y. The address pulse Pa of straight polarity is impressed to selection and coincidence of a line to the address electrode A corresponding to the cel which the subframe data Dsf show and which should be turned on. In the selected line, in the cel to which the address pulse Pa was impressed, opposite discharge takes place between the Sas Tin electrode Y and the address electrode A, and it shifts to field discharge. Discharge of these single strings is address discharge. Since bias of the Sas Tin electrode X is carried out to the potential of the address pulse Pa and like-pole nature, the address pulse Pa is negated on the bias, and discharge does not break out between the Sas Tin electrode X and the address

electrode A.
[0033] In order that the Sas Tin period TS may secure the brightness according to gradation level, it carries out bias of all the address electrodes A to the potential of straight polarity, and impresses the SASUTIN pulse Ps of straight polarity to all the Sas Tin electrodes Y first. Field discharge arises for every impression of the SASUTIN pulse Ps in the cel which wall charge accumulated in the address period TA. The impression period of the SASUTIN pulse Ps is fixed, and the SASUTIN pulse Ps of the number set up according to the weight of brightness is impressed.
[0034] in addition, the above-mentioned actuation approach -- an example -- it is -- ****** -- it is not limited to this actuation approach.
[0035]
[Effect of the Invention] It becomes possible to make it fall as much as possible in the range in which an address mistake does not produce Vsc, using the fluorescent substance of a zinc silicate system, since the laminating of the coat film which can make the polarity of a fluorescent substance layer a plus polarity is carried out according to PDP of this invention.

[Translation done.]